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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/574,052	10/13/2006	Masayoshi Takahashi	B-5926PCT 623364-3	9788

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EXAMINER	
STELLING, LUCAS A	

ART UNIT	PAPER NUMBER
1797	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/574,052	TAKAHASHI ET AL.	
	Examiner	Art Unit	
	Lucas Stelling	1797	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *21 May 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,2 and 4-17* is/are pending in the application.

4a) Of the above claim(s) *7-9 and 14-17* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1, 2, 4-6, and 10-13* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "adiabatic compression-like change." A person having ordinary skill in the art would not know to a reasonable degree either alone, or in light of applicant's specification, whether any given change is "adiabatic compression-like," or not. Moreover, it is not clear whether the limitations of claim 2 relate to the step of allowing the bubbles to dissipate gradually and naturally, or to the stimulated disappearance, or both.

3. Claim 4 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is not clear whether the "collapsing the microbubbles" of claim 4 are caused by allowing the bubbles to dissipate gradually and naturally, or by the stimulated disappearance, or both.

4. Claim 10 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 10 recites the limitation "a microbubble containing solution in a container connecting a circulation pipe by a circulation pump and making the solution path through an orifice plate or porous plate having a single or multiple

holes installed in the circulation pipe." It is unclear from this claim limitation whether this limitation refers to the structure of the apparatus used to carry out the method, or to some sort of method step in which the container somehow connects a circulation pipe to something using a circulation pump. Therefore, the claim does not clearly recite the mete-and-bounds of the invention for which protection is sought.

5. Claim 13 rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 13 recites the limitation "a container connecting a circulation pipe into a circulation pipe." It is unclear from this claim limitation whether this limitation refers to the structure of the apparatus used to carry out the method, or to some sort of method step in which the container somehow connects a circulation pipe to something using a circulation pump. It is also unclear, if this limitation refers to the structure of the apparatus, what that structure is, whether a single circulation pipe or two circulation pipe are intended, and in which one the orifice plate is installed in. Therefore, the claim does not clearly recite the mete-and-bounds of the invention for which protection is sought

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 1, 2, 4-6, and 10-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chahine in view of Takahashi.

10. As to claim 1, Chahine teaches a method for collapsing microbubbles **(See abstract and see col. 1 line 51, microbubbles are contemplated)**, the microbubbles having a diameter, the method comprising accelerating the speed of the microbubble size decrease and disappearance by applying a stimulation to the microbubbles **(See col. 13 lines 22-30, the jet is directed towards a wall which initates the collapse of the cavitation bubble)**, wherein a great amount of free radical species are released

from a gas-liquid interface **(See col. 5 lines 25-40, the collapsing microscopic bubble creates hydroxyl radicals in the liquid in the region of the collapse; and see col. 6 lines 50-52, increasing the overall cavity surface area in contact with water increases the probability that hydroxyls will be close enough to contaminants to react, which means that the hydroxyls will be released at the interface)** by increasing a charge density at the gas-liquid interface of the microbubbles **(See col. 6 lines 1-10, electric discharges are contemplated on collapse, and an electric discharge requires an increase in charge density prior to the discharge)**.

11. Chahine is different from claim 1 in that Chahine does not mention that the bubbles have a diameter of less than 50μm and that when they float in the solution they decrease gradually in size. Takahashi teaches the creation of microbubbles using a swirling fluid microbubble generator to produce microbubbles with a diameter distribution which includes microbubbles having a diameter of 50μm or less **(See Takahashi Figs. 1-3, and see page 2172, left column)**. Takahashi explains that bubbles of this size will naturally shrink while the amount of dissolved gas around the bubble increases **(See Takahashi page 2173)**. Furthermore, Takahashi explains that the pressure inside the bubble is inversely proportional to the radius of the bubble **(See Takahashi page 2173)**. A person having ordinary skill in the art would have recognized the usefulness of producing small bubbles, below 50μm in order to produce a more energetic collapse. Moreover, Takehashi contemplates that smaller bubbles will have higher surface areas **(See Takahashi page 2171)**, and Chahine contemplates that the surface area of the cavities is an important factor in determining the production of

hydroxyl radicals, and decontamination efficiency of the cavities **(See Chahine col. 6 lines 45-55)**. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to operate Chahine to produce microbubbles having a diameter of 50μm or less, as the swirling jet is capable of producing bubbles of that size, and in order to produce higher pressures within the bubble which produces a more energetic collapse, as well as to maintain a large surface area for the cavities.

12. As to claim 2, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates high temperature and pressure collapse of microbubbles in solution **(See col. 5 lines 60-68)**.

13. As to claim 4, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates the creation of hydroxyl radical, which constitutes an active oxygen species, which are used for decontamination **(See Chahine col. 45-55)**.

14. As to claim 5, Chahine and Takahashi teach the method of claim 1, and Chahine teaches using cavitation to eliminate organic and other contaminants from the liquids **(See Chahine col. 6 lines 1-10).**

15. As to claim 6, Chahine and Takahashi teach the method of claim 1, and Chahine contemplates using cavitation to treat microorganisms **(See Chahine col. 15 lines 1-15)**.

16. As to claim 10, Chahine and Takahasi teach the method of claim 1, and Chahine contemplates producing cavitation within a nozzle chamber, and then expelling the cavitation pockets out of the nozzle chamber in an annulus of axially flowing liquid **(See e.g. Fig. 5 and col. 12 lines 30-45)**. Chahine goes on to explain that the cavitation

nozzles are placed within a cavitation chamber which is connected to a recirculation pipe and pump **(See Figs. 8 and 9 and col. 13 line 56 -- col. 14 line 40)**. Chahine further provides plates, or walls, for causing the collapse of the bubbles **(Chahine col. 13 lines 35-40)**, and further specifies that the plates or walls contain orifices **(See Chahine col. 13 lines 40-42)**. But, Chahine does not specifically mention having the plate w/ orifices installed in the circulation pipe. Nonetheless, Chahine explains that when the swirling vortex with cavitation pockets is sheathed in an annulus of axially flowing liquid, that placement of the collapse inducing surface can be placed farther away from the nozzle outlet in order to extend the time in which cavitation is present while still advantageously causing violent collapse of the cavitation pockets **(See Chahine col. 13 lines 50-56)**. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to place the collapse inducing surface in the recirculation pipe downstream of the nozzle exit in order to increase the time in which cavitation is present, while still producing violent bubble collapse.

17. As to claim 11, Chahine and Takahashi teach the method of claim 10, and Chahine contemplates pressurizing the system to 60 psi **(Chahine col. 14 lines 35-37)**, which constitutes a pressure of 0.41 MPa.

18. As to claim 12, Chahine and Takahashi teach the method of claim 10, and Chahine teaches that the system is operable at atmospheric pressures **(See Chahine col. 14 lines 30-35)**. Therefore, in order to draw liquid in the negative pressure at the intake side of the pump would be less than the atmospheric pressure.

19. As to claim 13, Chahine and Takahasi teach the method of claim 1, and Chahine contemplates producing cavitation within a nozzle chamber, and then expelling the cavitation pockets out of the nozzle chamber in an annulus of axially flowing liquid **(See e.g. Fig. 5 and col. 12 lines 30-45)**. Chahine goes on to explain that the cavitation nozzles are placed within a cavitation chamber which is connected to a recirculation pipe **(See Figs. 8 and 9 and col. 13 line 56 -- col. 14 line 40)**. Chahine further provides plates, or walls, for causing the collapse of the bubbles **(Chahine col. 13 lines 35-40)**, and further specifies that the plates or walls contain orifices **(See Chahine col. 13 lines 40-42)**. But, Chahine does not specifically mention having the plate w/ orifices installed in the circulation pipe. Nonetheless, Chahine explains that when the swirling vortex with cavitation pockets is sheathed in an annulus of axially flowing liquid, that placement of the collapse inducing surface can be placed farther away from the nozzle outlet in order to extend the time in which cavitation is present while still advantageously causing violent collapse of the cavitation pockets **(See Chahine col. 13 lines 50-56)**. Therefore, it would have been obvious to a person having ordinary skill in the art at the time of invention to place the collapse-inducing surface in the recirculation pipe downstream of the nozzle exit in order to increase the time in which cavitation is present, while still producing violent bubble collapse.

Response to Arguments

20. Applicant's arguments filed 5-21-10 have been fully considered but they are not persuasive.

21. In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Applicant first argues that Takahashi is not concerned with accelerating the speed of microbubble collapse. In response, acceleration of the speed of microbubble collapse is taught in Chahine.

22. Applicant next argues that Chahine and Takehashi are concerned with different microbubble technologies. More specifically, applicant alleges that Takehashi is concerned with introducing gas to create bubbles, while Chahine uses boiling caused by hydrodyanmic cavitation. Applicant next alleges that the bubbles in Chahine have a condensable interior gas whereas those in Takahashi have an incondensable interior gas. Applicant then concludes that a person having ordinary skill in the art at the time of invention would have found it obvious to combine the teachings of Chahine and Takahashi. In response, first it is pointed out that a discussion of the "boiling," and condensability of the interior gas of the bubbles in Chahine was not found, and these alleged facts are therefore taken purely as unsupported attorney argument. The examiner was also unable to find a discussion of the alleged incondensable nature of the gas in Takahashi or that the gas is unable to undergo a "phase change from gas to the surrounding liquid when collapsing." To the contrary, Takahashi teaches that the gas may dissolve in the surrounding water, which would be a phase change from gaseous to aqueous/liquid **(See Takahashi page 2173, especially right column)**.

Moreover, the teachings of the two references are not inconsistent, Chahine also teaches that gasses may be added to the liquid **(See Chahine col. 15 lines 50-60).**

23. Applicant lastly argues that there is no teaching in Takahashi or Chahine of "wherein a great amount of free radical species are released from a gas-liquid interface by increasing a charge density at the gas-liquid interface of the microbubbles. In response, and as discussed above, Chahine teaches that the collapse of the bubbles produces hydroxyl radicals, surface area to volume ratios are an important factor in the decontamination process **(See Chahine col. 6 lines 45-55)**. Increasing the surface area to volume ratio increases the probability that contaminants will be in the vicinity of the bubble, and therefore the gas liquid interface, when it collapses and releases hydroxyl radicals. Moreover, that Chahine recognizes that the collapse of a microbubble produces an electric discharge means that an increase charge density has been produced **(See col. 6 lines 1-10)**.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lucas Stelling whose telephone number is (571)270-3725. The examiner can normally be reached on Monday through Thursday 12:00PM to 5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Las 7-21-10

/Matthew O Savage/
Primary Examiner, Art Unit 1797